DEPARTMENT of AGRICULTURE and NATURAL RESOURCES
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RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT APPLICATION NO. 8759-3, Ernest Namminga

Pursuant to SDCL 46-2A-2, the following is the recommendation of the Chief Engineer, Water Rights Program, Department of Agriculture and Natural Resources concerning Water Permit Application No. 8759-3, Ernest Namminga, 40786 310th Street, Springfield SD 57062.

The Chief Engineer is recommending APPROVAL of Application No. 8759-3 because 1) there is reasonable probability that there is unappropriated water available for the applicant's proposed use, 2) the proposed diversion can be developed without unlawful impairment of existing domestic water uses and water rights, 3) the proposed use is a beneficial use and 4) it is in the public interest as it pertains to matters of public interest within the regulatory authority of the Water Management Board with the following qualifications:

1. The well approved under Water Permit No. 8759-3 is located near domestic wells and other wells which may obtain water from the same aquifer. Water withdrawals shall be controlled so there is not a reduction of needed water supplies in adequate domestic wells or in adequate wells having prior water rights.

2. The well authorized by Permit No. 8759-3 shall be constructed by a licensed well driller and construction of the well and installation of the pump shall comply with Water Management Board Well Construction Rules, Chapter 74:02:04 with the well casing pressure grouted (bottom to top) pursuant to Section 74:02:04:28.

3. This Permit is approved subject to the irrigation water use questionnaire being submitted each year.

See report on application for additional information.

Eric Gronlund

Eric Gronlund, Chief Engineer
July 6, 2023

Report to the Chief Engineer
Water Permit Application No. 8759-3
Ernest Namminga
July 5, 2023

Water Permit Application No. 8759-3 filed by Ernest Namminga proposes to appropriate water at a maximum diversion rate of 1.78 cubic feet per second (cfs) from one well to be completed into the Choteau: West aquifer (approximately 238 feet deep) for irrigation use. The proposed well location is the approximate center of the NE ¼ of Section 10-T93N-R61W. The proposed land to be irrigated is 160 acres located in the NE ¼ of Section 10-T93N-R61W. This site is in Bon Homme County approximately eleven miles southwest of Tyndall, SD.

Aquifer: Choteau: West (CH:W)

Aquifer Information

The Choteau: West aquifer is a basal aquifer that underlies portions of Charles Mix, Douglas, and Bon Homme Counties (Hedges et al., 1982). Figure 1 shows the approximate areal extent of the aquifer. The aquifer lies primarily within the Choteau bedrock valley and is made up of buried outwash and western stream deposits (Kume, 1977; Jorgensen, 1971). The Choteau: West aquifer is primarily under confined conditions (Kume, 1977 and Water Rights, 2023c). Based on Hedges et al. (1982), the management unit has an estimated areal extent of approximately 218,400 acres and contains about 1,474,200 acre-feet of recoverable water. Groundwater movement in the aquifer is generally toward the south (Kume, 1977).

Two test holes were submitted with this application. The lithology for the test holes for this application is shown in Table 1, test hole 2 is closest to the proposed well site. The applicant indicated the target aquifer material is sand and gravel deposits. In this area, that aquifer material corresponds with the Choteau: West aquifer (Water Rights, 2023b), with the top of the aquifer in test hole 2 at 187 feet below grade. In this area, clay lenses within the sand and gravel of the Choteau: West aquifer are common (SDGS, 2023; Water Rights, 2023a). Based on area well information, the aquifer is expected to be under confined conditions (Water Rights, 2023a and 2023c).

Table 1: Test hole report submitted with Application No. 8759-3					
Test hole 1			Test hole 2		
Description	**From (ft)**	**To (ft)**	**Description**	**From (ft)**	**To (ft)**
top soil	0	8	top soil	0	6
clay- gray/black	8	17	clay brown	6	27
clay-brown	17	22	clay blue	27	31
clay-gray	22	27	gravel and clay	31	40
clay brown w/ chalk fragments	27	30	clay blue sandy & pebbly	40	132
clay gray	30	76	clay hard blue	132	162
chalk gray pebbly	76	132	gravel	162	167
clay gray sandy	132	157	clay	167	187
clay sandy & rock	157	159	sand & gravel	187	206
gravel	159	164	clay	206	212
clay w/gravel layers	164	170	gravel med w/ coarse layers	212	229
gravel w/ a few clay layers	170	178	clay gray	229	237
clay gray	178	185	chalk	237	240
gravel	185	189	bottom of test hole 240 ft		
clay gray	189	203			
chalk tan	203	209			
chalk gray/white	209	225			
bottom of test hole 225 ft					

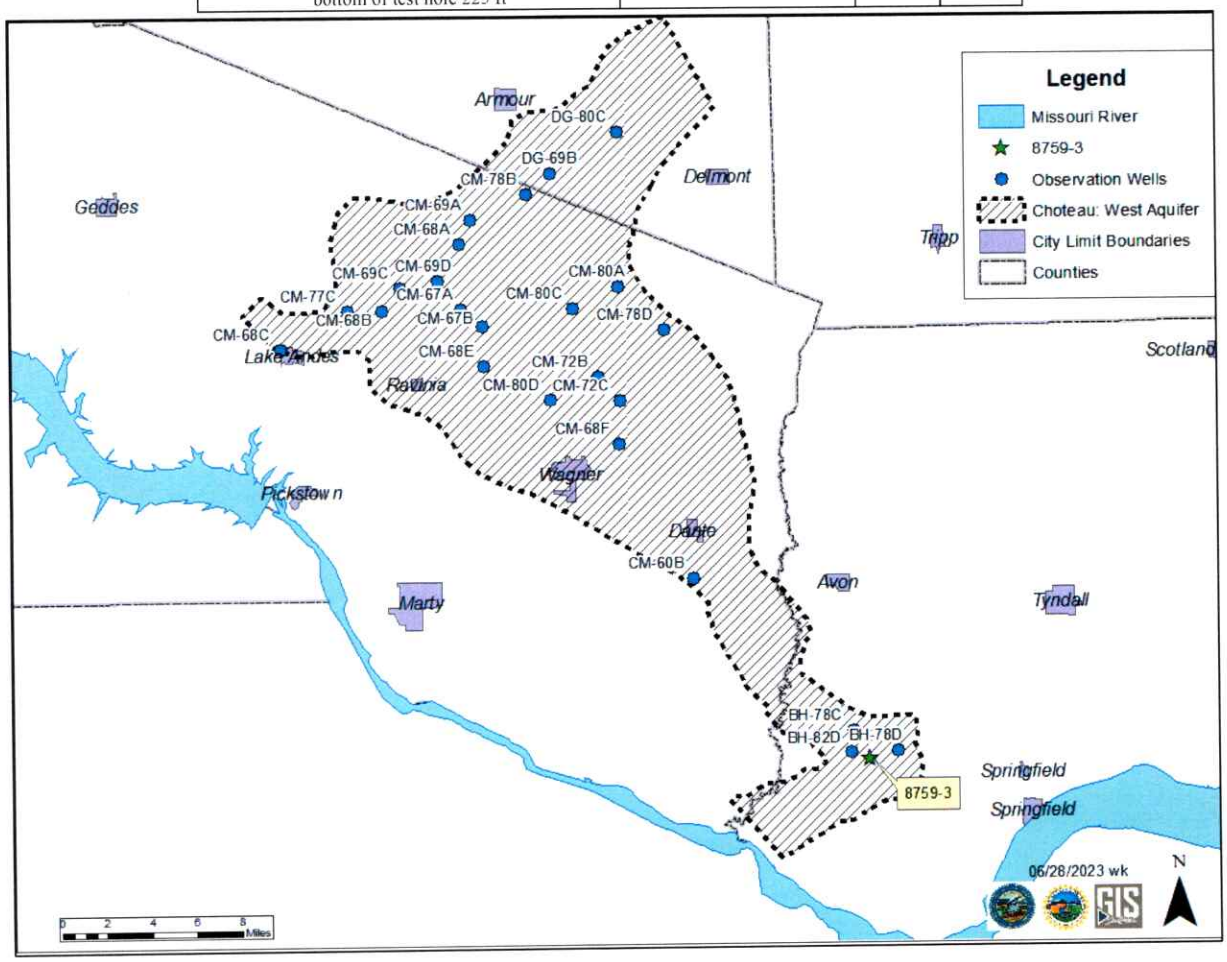

Figure 1: Approximate extent of the Choteau: West aquifer, location of the well site for this application, and observation wells completed into the Choteau: West aquifer (Hedges et al., 1982; Water Rights, 2023c)

In the area of this application, there is a history of difficulty in determining if the target aquifer is the Choteau: West aquifer or the Niobrara aquifer, even when test holes have been drilled

(Water Rights, 2023b). This is likely due to the slope of the side of the bedrock valley the Choteau: West aquifer is lying in and the presence of chalk blocks within the sand and gravel of the Choteau: West aquifer in this area (SDGS, 2023; Water Rights, 2023a). The shallowest aquifer material of mappable extent in the immediate vicinity of the proposed well site for this application is typically either the sand and gravel of the Choteau: West aquifer or the Niobrara (NBRR) aquifer (typically called chalk rock by drillers) (Jensen, 2012). Figure 2 shows the location of the proposed well site for this application and the first occurrence of aquifer materials for the area from Jensen (2012). A first occurrence of aquifer materials map is typically not a map that identifies individual glacial aquifers. Rather, it is a map with a range of depths to geologic materials of a mappable extent that have the potential to produce water. Jensen (2012) suggests that in the area of the well site for this application, the northern boundary of the Choteau: West aquifer is likely further south than mapped by Hedges et al. (1982), however, given the limited density of test holes deep enough to encounter the Niobrara Formation drilled with a geologist on site in the area (SDGS, 2023) the boundary suggested by Jensen (2012) should be treated as being approximate. The Choteau: West aquifer directly overlays and is adjacent to the Niobrara Formation in this area (SDGS, 2023; Water Rights, 2023a). Since the Niobrara Formation in this area can act as an aquifer (Water Rights, 2023a), there is likely some movement of water between the Niobrara aquifer and the Choteau: West aquifer. However, due to the lack of a long-term records from an observation well completed into this portion of the Niobrara aquifer, there is little to no data to evaluate the extent of the connection between the two aquifers in this area. This lack of data limits the evaluation of the nature of the boundary between the two aquifers in this area and evaluation of how the boundary will affect the amount of drawdown between a pumping well and the boundary. Additionally, Jensen (2012) suggests that the connection between the extent of the Choteau: West aquifer in Bon Homme County and the extent of the Choteau: West aquifer in Charles Mix and Douglas Counties is more limited that what was mapped by Hedges et al. (1982). The water rights/permits shown in Figure 2 are summarized in Table 2.

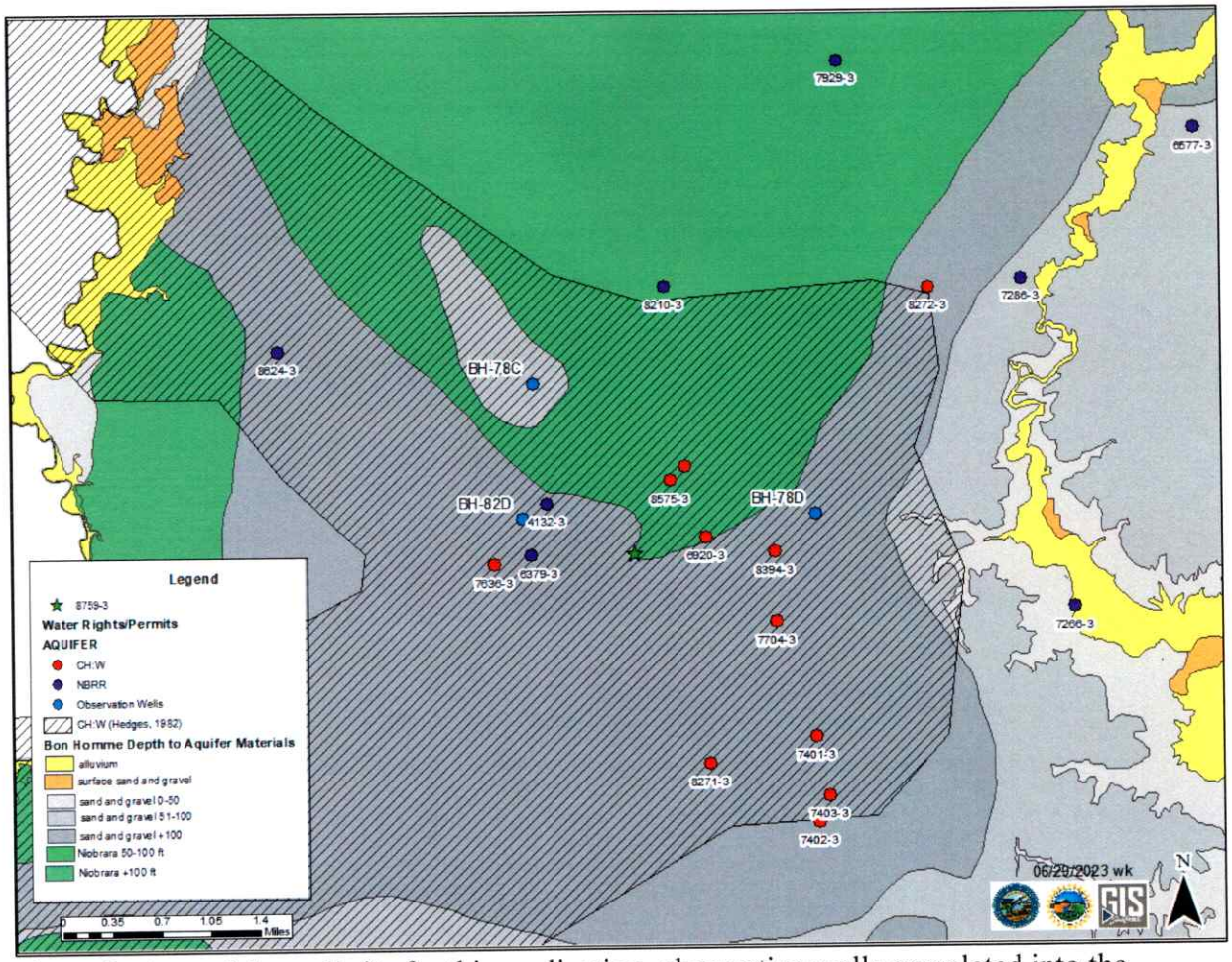

Figure 2: Area of the well site for this application, observation wells completed into the Choteau: West (CH:W) aquifer, water rights/permit permitted for the Choteau: West and Niobrara (NBRR) aquifers approximate extent of the Choteau: aquifer from Hedges et al. (1982) and depth in feet to first occurrence of aquifer materials from Jensen (2012) (Water Rights, 2023B and 2023c)

Table 2. Summary of Water Rights/Permits Shown in Figure 2

Permit No.	Last Name	First Name	Priority Date	Status	Aquifer	Use	Rate (cfs)	Acres
2320A-3	NAMMINGA	ERNEST R	08/04/1975	LC	CH:W	IRR	1.78	248
4132-3	TJEERDSMA	HAROLD	01/27/1978	LC	NBRR	IRR	2	164
6379-3	VANDERLEI	LEON	01/02/2003	LC	NBRR	IRR	1.67	136
6577-3	BOCHMAN	DOUGLAS	01/24/2005	LC	NBRR	IRR	1.08	76
6920-3	FOUR WINDS ENTERPRISES LLC		12/10/2007	LC	CH:W	IRR	1.78	131
7266-3	JELSMA	VERLYN & JEREMIE	09/06/2011	LC	NBRR	IRR	1.33	109
7286-3	KOZAK	BRIAN	12/14/2011	LC	NBRR	IRR	1.44	185
7401-3	VANDERLEI	LEON	08/06/2012	LC	CH:W	IRR	2	190
7402-3	VANDERLEI	CRAIG	08/20/2012	LC	CH:W	IRR	1.78	241
7403-3	VANDERLEI	CRAIG	08/20/2012	LC	CH:W	DOM	0.075	n/a
7636-3	JELSMA	VERLYN	01/07/2013	LC	CH:W	IRR	0.58	69
7704-3	JELSMA	IVAN	02/21/2013	LC	CH:W	IRR	1.78	133
7929-3	BIEREMA	BRAD	12/02/2013	LC	NBRR	IRR	1.11	135
8210-3	VANDERLEI	CRAIG	03/25/2016	LC	NBRR	IRR	1.11	130
8271-3	VANDERLEI	LEON	03/12/2004	LC	CH:W	IRR	1.89	399
8272-3	VANDERLEI	CRAIG	03/16/2017	LC	CH:W	IRR	1.11	68
8394-3	VANDERLEI	CRAIG	04/08/2010	LC	CH:W	IRR	1.89	266
8575-3	NAMMINGA	ERNEST R	12/21/2021	LC	CH:W	IRR	1.78	124
8624-3	JOHNSON	MARK	03/28/2022	PE	NBRR	IRR	1.56	160

The production well completion report has been submitted for the well for Water Permit No. 8624-3. The report indicates that the well was screened into sand and gravel indicating the production well for Permit No. 8624-3 is completed into the Choteau: West aquifer and not the Niobrara aquifer as permitted (Water Rights, 2023b).

A review of the production well for Water Right No. 6379-3 permitted for the Niobrara aquifer indicated that the well is screened into 15 feet of coarse gravel and 14 feet of chalk directly underlying the coarse gravel (Water Rights, 2023b). The static water level at the time of completion (July 17, 2003) for this well was 120 feet below grade, using the State of South Dakota's one meter resolution bare earth LiDAR DEM land surface elevation at this well is estimated to be approximately 1,450 feet (NAVD88) so water level at time of completion is estimated approximately 1,330 feet (NAVD88). Observation well BH-82D monitoring the Choteau: West aquifer is located approximately 0.26 miles north of the well for Water Right No. 6379-3, had a measured water level of 134.5 ft below the top of casing (well stick up 1.6 ft) on July 12, 2003 (Water Rights, 2023c). Using the State of South Dakota's one meter resolution bare earth LiDAR DEM land surface elevation at this well, it is estimated to be approximately 1,450 feet (NAVD88) so the water level on July 12, 2003, is estimated at approximately 1,317.1 feet (NAVD88). Given this similarity in water level elevation and the screen information, it is extremely likely that the production well for Water Right No. 6379-3 is pumping some amount of water directly from the Choteau: West aquifer.

A well completion report for Water Right No. 4132-3 is not available; however, the licensing inspection does contain some basic information on the well. The inspection report for Water Right No. 4132-3 indicates the production well is 250 feet deep with a screen length of 80 feet, a static water level of 160 below grade, and the well was likely drilled around 1978 (Water Rights, 2023b). Using the State of South Dakota's one meter resolution bare earth LiDAR DEM land surface elevation at this well is estimated to be approximately 1,486.7 feet (NAVD88), so the approximate bottom of the well is 1,236.7 feet (NAVD88), estimated top of the well screen is 1,316.7 feet (NAVD88), and approximate water level elevation is 1,326.7 feet (NAVD88). Observation well BH-82D monitoring the Choteau: West aquifer is located approximately 0.30 miles southwest of the well for Water Right No. 4132-3, the earliest water level reading for BH-82D is 137.3 ft below top of casing (approximately 1,314.3 ft (NAVD88)) (Water Rights, 2023b).

In reviewing the lithology for BH-82D the top of the Choteau: West aquifer is likely at 188 ft below grade (1,262 ft (NAVD88)) and the top of the Niobrara Formation at 233 ft below grade (1,217 ft (NAVD88) (Water Rights, 2023c). Even accounting for the top of the Niobrara Formation at the well site for Water Right No. 4132-3 being expected to be higher in elevation than at the location of BH-82D (due to the slope of the side of bedrock valley), based on the available information, there is a high probability that the production well for Water Right No. 4132-3 is at least partially screened into the Choteau: West aquifer.

Based on the above discussion, Water Right No. 4132-3, Water Right No. 6379-3, and Water Permit No. 8624-3 will be included in the hydrologic budget for this application despite being permitted for the Niobrara aquifer.

South Dakota Codified Law (SDCL) 46-2A-9

Pursuant to SDCL 46-2A-9, "A permit to appropriate water may be issued only if there is a reasonable probability that there is unappropriated water available for the applicant's proposed use, that the diversion point can be developed without unlawful impairment of existing domestic water uses and water rights, and that the proposed use is a beneficial use and in the public interest as it pertains to matters of public interest within the regulatory authority of the Water Management Board as defined by SDCL 46-2-9 and 46-2-11." This report section will address the availability of unappropriated water and the potential for unlawful impairment of existing domestic water uses and water rights within this aquifer.

Water Availability

Water Permit Application Nos. 8759-3 proposes to appropriate water from the Choteau: West aquifer for irrigation use. The probability of unappropriated water being available from an aquifer can be evaluated by considering SDCL 46-6-3.1 which requires, "No application to appropriate groundwater may be approved if, according to the best information reasonably available, it is probable that the quantity of water withdrawn annually from a groundwater source will exceed the quantity of the average estimated annual recharge of water to the groundwater source." If the source of the water is older or lower than the Greenhorn Formation and the application is for a water distribution system defined in SDCL 46-1-6 (17), the Board need not consider the recharge/withdrawal issue. This application is not for a water distribution system as defined in SDCL 46-1-6 (17) and the Choteau: West aquifer is not older and stratigraphically lower than the Greenhorn Formation. Therefore, the withdrawal/recharge issue must be considered.

Observation Wells

In determining the availability of unappropriated water for a permit application Administrative Rule 74:02:05:07 requires the Water Management Board to rely on the record of observation well measurements, in addition to other data, to determine that the quantity of water withdrawn annually from the aquifer does not exceed the estimated annual recharge.

The Water Rights Program monitors 25 observation wells completed into the Choteau: West aquifer, two (CM-68B and BH-82D) of which have had measurements recently suspended due to maintenance considerations. The majority of the observation wells in the Choteau: West aquifer have a stable to slightly increasing trend over their periods of record with some observation

wells also documenting seasonal pumping of nearby irrigation wells but returning to pre-irrigation pumping levels with the end of the irrigation season and spring recharge. The hydrograph for observation well CM-68F (Figure 3) located approximately 17 miles northwest of the well site for this application is representative of the general behavior of the majority of observation wells in the Choteau: West aquifer. These observation wells indicate the aquifer responds well to climatic conditions because water levels rise during wetter periods and decline to a stable water level during drier periods. Additionally, the water levels in the majority of Choteau: West aquifer observation wells display that the amount of recharge to and natural discharge from the aquifer exceeds pumping. Aquifer behavior indicates that climatic conditions and therefore, the effects of recharge to and natural discharges from the aquifer govern the long-term fluctuations of waters levels in the aquifer rather than the impacts of pumping from the Choteau: West aquifer. By recognizing that both recharge to and natural discharge from an aquifer can be captured for pumping, the observation well hydrographs demonstrate unappropriated water is available from the aquifer for the proposed appropriation. However, the hydrographs of two observation wells in Bon Homme County (BH-82D and BH-78D) are not representative of the other observation wells in the aquifer (Water Rights, 2023c).

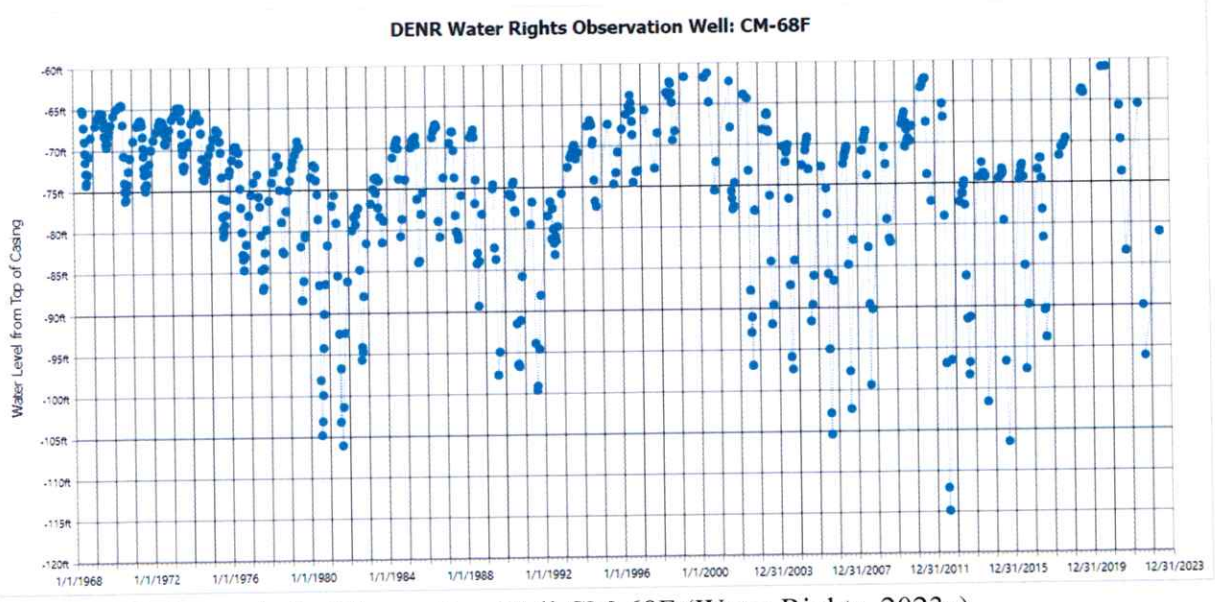

Figure 3: Hydrograph for Observation Well CM-68F (Water Rights, 2023c)

The nearest observation wells to the proposed well site for this application are BH-82D (0.8 miles to the west), BH-78D (1.3 miles to the east), and BH-78C (1.4 miles to the northwest) (Water Rights, 2023c). The hydrographs for these observation wells are shown in Figures 4, 5, and 6. Although included in this report, Jensen (2012) and the hydrograph for BH-78C are both suggestive of observation well BH-78C being completed into a sand and gravel deposit not directly connected to the Choteau: West aquifer. Therefore, the remaining observation well analysis will focus on observation wells BH-82D and BH-78D.

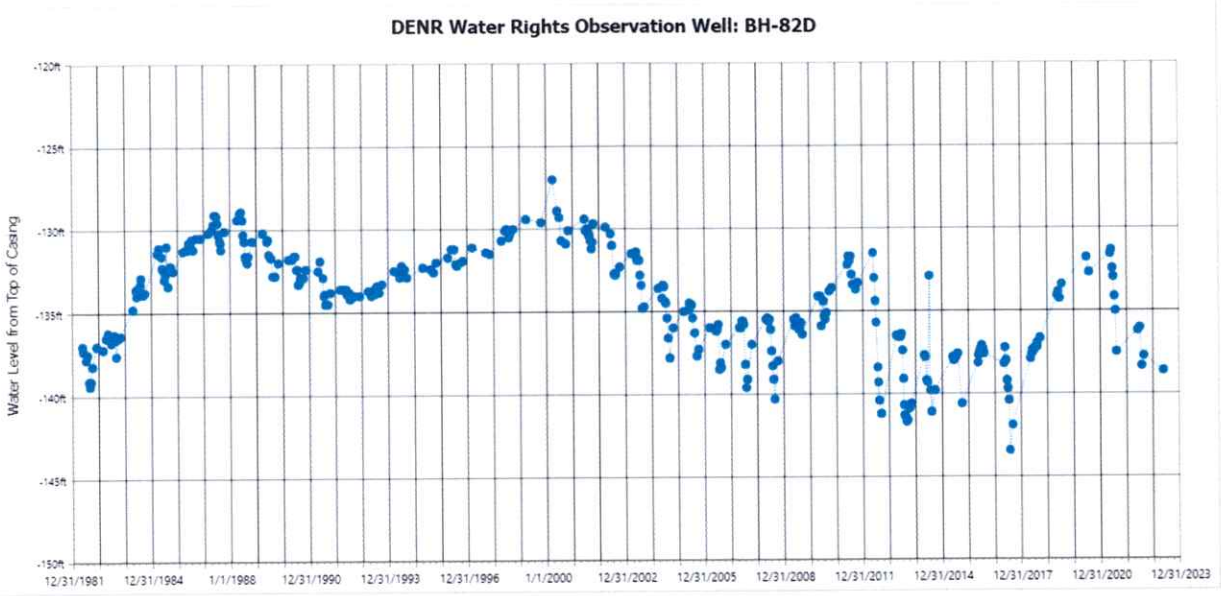

Figure 4: Hydrograph for Observation Well BH-82D (Water Rights, 2023c)

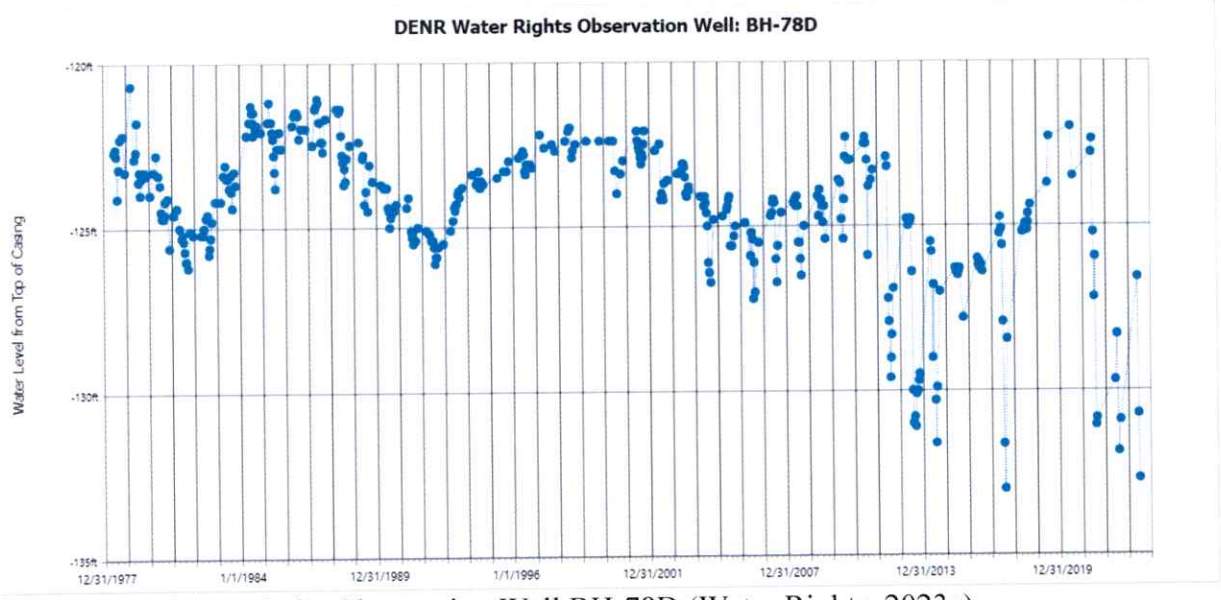

Figure 5: Hydrograph for Observation Well BH-78D (Water Rights, 2023c)

Figure 6: Hydrograph for Observation Well BH-78C (Water Rights, 2023c)

The hydrographs for observation wells BH-82D and BH-78D have slightly decreasing trends over the period of record; however, within this trend the aquifer still responds to responds well to climatic conditions (for example the response to the wetter conditions in 2019). The aquifer is under confined conditions at the location of both of these observation wells (Water Rights, 2023c). In considering the hydrograph for BH-82D, the aquifer appears to have stabilized in relation to development around 2012. In considering the hydrograph for BH-82D, additional data is needed to determine is the aquifer is still stabilizing in relation to newer appropriations in the area or has stabilized. From the measuring point (top of casing) the top of the aquifer at BH-82D is approximately 189.4 feet below the measuring point and at BH-78D is approximately 133 feet below the measuring point (Water Rights, 2023c). The lowest recorded water level for BH-78D was approximately 133.01 feet below top of casing (July 25, 2017) and the lowest recorded water level for BH-82D was 143.43 feet below top of casing (July 25, 2017). At the lowest measured water level for BH-82D there was approximately 45 feet of artesian head pressure remaining and at the lowest measured water level for BH-78D approximately at the top of the aquifer (approximately 0.01 feet below the top of aquifer). In considering Figure 2, these observation wells are located between high-capacity irrigation wells and an aquifer boundary, which could result in additional drawdown due to pumping during the irrigation season compared to other directions from the pumping wells.

Hydrologic Budget

Recharge

Some recharge for the management unit is from the adjacent till (Kume, 1977). In the areas where the management unit is in contact with the Niobrara aquifer, the potential exists for some recharge to the management unit from the Niobrara aquifer (Kume, 1977). Water movement between aquifers can occur when the potentiometric surface (water level) in one aquifer is higher than the potentiometric surface in a connected aquifer, with water movement occurring from

higher to lower potentiometric surface. Mathiowetz (2016) notes that the most likely area for recharge from the Niobrara to occur is in the township located at T98N-R63W and potentially other areas along the northwest side of the aquifer. In Bon Homme County some recharge is received via seepage from Dry Choteau Creek and Choteau Creek (Jorgensen, 1971). Utilizing the recharge rates recommended by Hedges et al. (1985) for use by management and development programs for confined aquifers of 0.15 to 0.60 inches per year and an area of 218,400 acres, the estimated annual recharge to the management unit is 2,730 to 10,920 acre-feet per year with the midpoint of this range being 6,825 acre-feet per year. When using the general range of recharge to the confined aquifers recommended by Hedges et al. (1985), the Water Rights Program has historically targeted the midpoint of the range for evaluating the balance between recharge and withdrawals, unless information (like observation well data) exists to indicate recharge is higher or lower than the middle of the range (Water Rights, 2023b).

Withdrawals

Withdrawals from the management unit consist of natural losses to springs (in the southern part of the management unit), seepage to surrounding bedrock or drift, and pumping from wells (Kume, 1977). Mathiowetz (2016) notes that based on observation well data along the eastern edge of the management unit there is potential for water to move into the Niobrara aquifer where it is in contact with the management unit. Withdrawals due to wells can be split into irrigation and non-irrigation uses. The majority of water rights/permits for this management unit are for irrigation use. Due to the relatively low diversion rate of domestic wells, the development of rural water systems over a large portion of the area where the Choteau: West aquifer is the upmost aquifer available, and the availability of shallower aquifers over a large extent of the Choteau: West aquifer; withdrawals from domestic wells are assumed to be a negligible portion of the hydrologic budget.

Jensen (2023) in a report dated March 29, 2023, reviewed average annual appropriative use to this aquifer. The best available information indicates there have been no significant changes to average annual non-irrigation appropriative use since this review. Jensen (2023) estimated water use for the six non-irrigation water rights/permits authorized to appropriate water from the Choteau: West aquifer at approximately 351 acre-feet per year. There are no future use permits reserving water from the Choteau: West aquifer (Water Rights, 2023b).

Jensen (2023), to reflect the current development of irrigation water rights/permits more accurately, used the average annual withdrawal rate from water use reported on irrigation questionaries for irrigation water rights/permits from the Choteau: West aquifer from 2012 to 2021 (approximately 3,029 acre-feet per year) and estimated one foot of water per acre per year of use for recently issued irrigation water permits that have not yet reported water use (477 acre-feet per year). The estimated average annual irrigation use from the Choteau: West aquifer by Jensen (2023) did not include estimated average use from Water Right No. 4132-3, Water Right No. 6379-3, and Water Permit No. 8624-3. Annual reported use for Water Right No. 4132-3 and Water Right No. 6379-3 is summarized in Table A1 in Appendix A. To be consistent with the irrigation data from Jensen (2023) average annual use for Water Right No. 4132-3 and Water Right No. 6379-3 from 2112 to 2021 is 216 acre-feet per year. The well for Water Permit No. 8624-3 was completed in August 2022 (Water Rights, 2023b), so water use for the permit will be estimated at one foot of water per acre per year (136 acre-feet per year). This results in a total estimated average annual

withdrawal rate for the irrigation appropriations of 3,858 acre-feet per year (Jensen, 2023 and Water Rights, 2023e). Using the same rate of one foot of water per acre per year of use, water use associated with this application for irrigation is conservatively estimated at 160 acre-feet per year.

Summary

Estimated average annual recharge to the Choteau: West aquifer ranges from 2,730 acre-feet per year to 10,920 acre-feet per year, with the midpoint of this range being 6,825 acre-feet per year. The estimated average withdrawal rate from the Choteau: West aquifer totals to approximately 4,369 acre-feet/year; (non-irrigation: 351 acre-feet per year; irrigation: 3,858 acre-feet per year; and this application: 160 acre-feet per year). Based on the hydrologic budget, there is a reasonable probability unappropriated water is available from the Choteau: West aquifer for the proposed appropriation, which is supported by the review of observation well data for the aquifer.

Potential for Unlawful Impairment

Water rights/permits currently authorized from the Choteau: West aquifer in the vicinity of the well site of this application are shown in Figure 2 and summarized in Table 2. The nearest water right/permit to the proposed well site for this application is Water Right No. 6920-3 for irrigation located approximately 0.51 miles to the east-northeast (Water Rights, 2023b). The nearest domestic well on file with the Water Rights Program to the well site for this application likely completed into the Choteau: West aquifer is located approximately 1.8 miles to the southeast (well locations based on the location report filed by the well driller); however, there may be closer domestic wells completed into the Choteau: West aquifer not on file with the Water Rights Program.

The exact amount of drawdown as a result of the diversion requested by this application cannot be quantified without aquifer testing. However, the Theis equation can be used to roughly estimate drawdown from a pumping well in a confined aquifer. Utilizing a transmissivity of 12,700 ft^2/d (Kume, 1977), a storativity of 0.00005 (Duffield, 2019), and a time of 45.3 days the calculated drawdown estimated at a distance of 0.5 mile is 7.92 feet, one mile is 6.58 feet, and 1.3 miles is 6.08 feet (Utah, 2010). The time of 45.3 days would allow for the application of 160 acre-feet of water at a continuous pumping rate of 1.78 cfs, which is a slightly conservative scenario. At the nearest observation well (BH-82B) located 0.8 miles from the well site for this application, at the lowest recorded reading for the observation well there was still approximately 45 feet of artesian head pressure at the location of observation well BH-82B. At the lowest recorded reading for observation well BH-78D, the water level is near the top of the aquifer and nearing unconfined conditions, drawdown as a result of pumping in unconfined conditions is typically less than in confined conditions. However, since at the maximum recorded drop in artesian head pressure due to pumping at this observation well is near the top of the aquifer, out of an abundance of caution, a qualification that withdrawals should be controlled so there is not a reduction of needed water supplies in adequate domestic wells or in adequate wells having prior water rights is suggested.

The Water Management Board recognizes that putting water to beneficial use requires a certain amount of drawdown to occur. The Board has developed rules to allow water to be placed to maximum beneficial use without the necessity of maintaining artesian head pressure for

domestic use. The Water Management Board defined an "adversely impacted domestic well" in ARSD 74:02:04:20(7) as:

> "A well in which the pump intake was set at least 20 feet below the top of the aquifer at the time of construction or, if the aquifer is less than 20 feet thick, is as near to the bottom of the aquifer as is practical and the water level of the aquifer has declined to a level that the pump will no longer deliver sufficient water for the well owner's needs."

The Water Management Board considered the delivery of water by artesian head pressure versus maximum beneficial use during the issuance of Water Right No. 2313-2 for Coca-Cola Bottling Company of the Black Hills. The Board adopted the Findings of Facts and Conclusions of Law that noted the reservation of artesian head pressure for delivery of water would be inconsistent with SDCL 46-1-4 which states, "general welfare requires that the water resources of the state be put to beneficial use to the fullest extent of which they are capable..." (Water Rights, 1995). Furthermore, the Water Management Board found if increased cost or decreased production as a result of impacts on artesian head pressure by legitimate users is to be considered as an unlawful impairment, it would also conflict with SDCL 46-1-4 (Water Rights, 1995). With that in mind, some existing well owners may need to install or lower pumps depending on the specific characteristics of the Choteau: West aquifer at their location. A review of the complaints on file with the Water Rights Program indicate that there is not a recent history of unlawful impairment occurring with Choteau: West aquifer wells in Bon Homme County (Water Rights, 2023d). When considering the statutes (SDCL 46-1-4 and 46-6-6.1), rule (ARSD 74:02:04:20(7)), the artesian head pressure at the nearest observation well to the well site for this application at its lowest recorded water level, and the lack of recent well interference complaints from the Choteau: West aquifer in the area, any drawdown created from the proposed diversion is not expected to cause an unlawful impairment to existing water right/permit holders or domestic users with adequate wells. Therefore, there is a reasonable probability that any interference from the proposed appropriation will not impose unlawful impairments on existing users with adequate wells.

Historical Concerns

In the 1950's in this area there was some concern over the impact of irrigation development on artesian head pressure. This concern was part of a study reported on in Walker (1961). Walker (1961) concluded that irrigation pumping had caused some domestic wells to stop flowing or created the need for pumps to be lowered as a result of the sensitivity of the artesian head pressure to irrigation pumping. The concerns have since been dealt with, and there have been no further issues in the area for several years. Concerns such as these are now addressed by SDCL 46-6-6.1 in which artesian head pressure is not protected as a means of groundwater delivery.

Conclusions

1. Water Permit Application No. 8759-3 filed by Ernest Namminga proposes to appropriate water at a maximum diversion rate of 1.78 cfs from one well to be located approximate center of the NE ¼ of Section 10-T93N-R61W completed into the Choteau: West aquifer for the irrigation 160 acres located in the NE ¼ of Section 10-T93N-R61W.

2. Based on observation well data and the hydrologic budget, there is a reasonable probability that unappropriated water is available from the Choteau: West aquifer to supply the proposed appropriation.

3. There is a reasonable probability that the diversion by Water Permit Application No. 8759-3 will not unlawfully impair adequate wells for existing water rights/permits or domestic uses.

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Appendix A: Irrigation Data for Water Right No. 4132-3 and Water Right No. 6379-3

Table A1: Reported Irrigation for Water Right Nos. 4132-3 and 6379-3 (Water Rights, 2023e)

	Permit No	4132-3	6379-3	Total Reported Irrigation
	Priority Date	01/27/1978	01/02/2003	
	Acres	164	136	
Year	Reported Irrigation (acre-feet)			
2021		102.47	114.9	217.37
2020		14.09	80.1	94.19
2019		0	22.1	22.1
2018		0	0	0
2017		159.09	56.68	215.77
2016		34.25	58.33	92.58
2015		62.97	91.92	154.89
2014		198.86	106.06	304.92
2013		95.5	258.52	354.02
2012		324.81	374.53	699.34
2011		63.64	66.29	129.93
2010		15.47	30.93	46.4
2009		0	14.14	14.14
2008		186.93	176.77	363.7
2007		113.35	200.34	313.69
2006		167.93	148.49	316.42
2005		79.55	149.15	228.7
2004		234.77	106.06	340.83
2003		139.2	64.96	204.16
2002		215.44		215.44
2001		47.73		47.73
2000		127.27		127.27
1999		51.7		51.7
1998		27.84		27.84
1997		50		50
1996		95.45		95.45
1995		27.84		27.84
1994		0		0
1993		0		0
1992		6		6
1991		32		32
1990		0		0
1989		35		35
1988				0
Overall Average		**82.1**	**111.6**	**142**
Average (2012-2021)		**99.2**	**116.314**	**215.5**